Developing a Course in Report Writing Skills

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ABSTRACT

In order to meet the pressing problem of training first year students to write competent science reports, a course in Report Writing has been integrated into the undergraduate practical laboratories of a physics unit. This course uses a functional approach and was designed by language specialists to meet the requirements of the Physics department. At the commencement of the course less than 50% of the students were able to demonstrate a desirable level of competency; this figure rose to 80% by the end of the course. The surveys showed that the overall laboratory course was outstandingly popular with both the students and the staff who administered the course. Much of this popularity has been attributed to the clear, effective and simple marking procedures used for assessment.

KEYWORDS

Undergraduate laboratories, functional guidelines, marking criteria, clear objectives, interdisciplinary teaching, assessment of course effectiveness.

INTRODUCTION

For the last seven years, the Physics Department at Macquarie University, along with academic staff from English for Academic Purposes (EAP), has been developing models for encouraging best practice in Report Writing, as well as seeking the most effective means of communicating this information to the students. For undergraduate students, a set of guidelines was prepared with the active participation of all Physics staff (Physics Department 2000). These evolving guidelines were used by the staff of EAP when developing courses for use in the Physics undergraduate laboratories (Roger et al. 1999). This report concerns the two most recent presentations of a Report Writing course to a first year class in the unit “Physics for Technology”. This unit is for students who are mostly continuing in studies in Computing and Information sciences. The inclusion of the Report Writing component has the enthusiastic approval of the Computing Department with whom most of the students will be continuing their studies.

There are a number of reasons behind this growing commitment towards teaching writing skills in this specific genre. The first reason is the increasing professional component of modern science

courses; in the case of the Physics Department, this became apparent when the successful Optoelectronics course was introduced at the beginning of the 1990s. The second reason is the large component (well in excess of 50%) of overseas students who choose to do the related Information and Communications Sciences. A third, minor reason, is the surviving tradition that some students with less literary aptitude chose to study the sciences and engineering with their mathematical bias, rather than struggle with the essays required in many other disciplines.

In the undergraduate physics laboratories in the past, students have only been confronted with the issue of Report Writing when asked to do a final "special" report on part of their work. Over the last ten years, it became obvious that many students were not able to produce competent special reports. The preliminary tasks in the laboratory required the production of brief notes; very often little feedback on the use of language was offered. In 2001, the authors developed a Report Writing course and presented it to the unit. This was done using three lectures and three tutorial/workshops exclusively dealing with the language for a report. In the third workshop, all aspects of scientific report writing were covered and the students were asked to submit a final special report. While the content of these presentations was generally satisfactory, it was concluded that the mode of presentation needed to be reconsidered. From class discussion and end of session questionnaires, a number of problems were identified:

- The lectures were not considered an appropriate venue for this material.
- Students need regular feedback and opportunities for discussion as they develop their skills.
- Students prefer assessment credit for all aspects of their work.
- Students find it stressful to write elaborate reports when they are starting to prepare for their final examinations.

In 2002, the Report Writing course was modified to overcome these and other problems. In addition, a special report writing pre-test was devised so that student competencies could be compared before and after the Report Writing course.

METHODS

Following the course development in the previous year, a three-page section on *Scientific Report Writing in the Physics Laboratory* was included in the laboratory manual. The manual also contains information on safety, laboratory procedures and numeracy. The report writing section covers language and style with guidelines tailored for the unit. The guidelines are carefully written from a functional point of view and are normative rather than prescriptive (Jones and Freeman 2002). Consequently, in assessment the markers are able to accept reasonable exceptions; after all clarity and communication is the objective of the course. The guidelines are consistent with those given by the Physics Department (loc. cit.) as well as those in the frequently used textbook by Kirkup 1994. The structural format consists of *Introduction, Equipment and Method(s), Results and Uncertainties, Discussion* and *Conclusions*; this set was considered adequate for a first year laboratory report.

In the pre-test, which was included in the first assignment for the unit, students were asked to do a computer simulation of a typical experiment and write a brief formal report. Each student had a copy of the laboratory manual and had attended a preliminary laboratory session before completing this initial exercise. These reports were marked, assessed and returned to the students as part of their regular assignment tasks. The reports were later re-marked, using the same criteria that were used to mark the final report. This was done to enable direct comparisons.

An early laboratory session took the form of a workshop in Report Writing; by this stage, the students were quite familiar with the laboratory requirements and the laboratory environment. The workshop used a tandem presentation by the authors; the first author covered the scientific requirements of a report, while the second covered language and style. At this workshop, both the students and the laboratory demonstrators had opportunities to comment and seek clarifications. The senior demonstrators all had extensive experience in Physics Report Writing and they showed a keen interest in the language section of the presentation. They were comfortable with the functional approach to the grammar and style of lab reports as introduced by the language specialists. The open nature of the workshop discussion requires the specific skills of these EAP specialists. The workshop covered a critical analysis of a contrived "poor" student report (Physics Department 2002). For assessment credit from the workshop, students were required to mark an improved "average" student report (loc. cit.). For this task they were asked to identify and highlight areas that could be improved and give brief comments on how this improvement could be achieved. The students had to be clearly told that they were not required to assess the average report, they had merely to highlight problems to show they had a good understanding of the principles discussed in the workshop.

After the first workshop, the student reports from the following laboratory sessions were marked in accordance with the principles that had been set out. For ease of assessment, 2 marks were awarded for Language and 2 marks were awarded for Scientific Content. In each case, a mark of 1 indicated serious problems that warranted specific discussion with the marker, while a mark of 2 indicated satisfactory progress despite faults that had been identified by the marker. Students with poor scores were not forced to consult the supervisors, they often found it easier to discuss and share information amongst themselves. This simple marking, which provided feedback and discussion the following week, was the major difference in the presentations between the two years. It was considered to be a vital component of the teaching and the marking hours (including training) were written into the Physics teaching budget.

A second workshop was used in the final laboratory session, which took place during the second to last week of the semester. At this workshop, there was an hour of summary and discussion and then the students were asked to write their special (formal) report during the workshop. The report was to be drawn from their marked notebooks and follow all the requirements of the laboratory manual. Again, cooperation between students was encouraged and the supervisors and workshop presenters were available for advice and assistance. By the end of the three-hour workshop, the students were required to hand in the special report. These were marked for twice the usual credit. These sessions were remarkably successful in that all students were able to complete their task within the scheduled three hours. Further, despite (or perhaps because of) the co-operative nature of the workshop there was no evidence of direct copying of reports. In addition, there were no requests for special consideration or extensions of time. The reports were marked and the results posted before the semester had ended.

The final special reports (as well as the pre-tests) were assessed using 4 marks for Language and 4 marks for Content. The criteria were developed following the principles outlined by Biggs 1999. The stated marking criteria were:

4 marks	Mastery of all principles (some obvious editorial errors permitted).
3 marks	At least one principle has been violated (self-editing will be possible when this mistake has been pointed out).
2 marks	Several principles have been violated (further discussion is needed before editing).
1 mark	Failure to master the principles (this part of the unit has been failed).

The clear criteria and simple 4-point scale enabled quick assessment so that the final results could be posted in the last week of the semester. This also allowed for a quick resolution of appeals, or questions, concerning the grading. The first author did all the marking of the final reports for both years; he also remarked the pre-tests. The total marks awarded for all components of the Report Writing Skills section counted towards 10% of the overall unit assessment.

RESULTS

The results for this section are drawn from the marks for the final special reports submitted in 2001 and 2002. In addition, the marks for the marks for the pre-test can be compared with those for the final reports in 2002. These results cover a class of approximately two hundred in each year.

Table 1.
A comparison of final report results (as percentages of the class) between the two years.

Year	2001				2002			
Mark	4	3	2	1	4	3	2	1
Language	37	34	20	9	42	37	18	3
Content	29	33	27	11	27	41	24	8

Table 2.
A comparison of results (as percentages of the class) between the start and finish of the course in 2002.

	start				finish			
Mark	4	3	2	1	4	3	2	1
Language	9	37	40	14	42	37	18	3
Content	10	23	49	18	27	41	24	8

When using a four (or eight) point marking scale it is difficult to find a meaningful statistical method of quantifying correlations. For this reason, we elected to simply give the two tables above. Either of these tables verifies that around 70% of the students had a final score of 6 or more out of 8. When comparing the Language and Content scores, 91% were the same or varied by 1 mark (out of 4). We also compared exam results with report writing scores. Of the students in the top 20% the range of exam scores, 86% scored 7 or 8 marks and none scored less than 5. As might be expected, a few students at the bottom end of the range had scores of 6 or 7.

In the year 2001 student evaluations taken from the report writing classes showed that 81% of the respondents found the course necessary or useful. In the year 2002 a redrafted evaluation showed that 89% thought their report writing skills had improved. In 2001, grudging attendance at the laboratory sessions (and even graffiti complaints) marked some student discontent. This was attributed to factors that were not related to the Report Writing Course. By contrast, in 2002 a survey showed that the laboratory component was the most popular section of the unit. The most significant change in the laboratory procedures between the years was the introduction of regular marking along with the criteria based assessment. This scheme required specific training for the markers.

DISCUSSION

The marking criteria were qualified in the following way:

- 4 indicates mastery of the principles,
- 3 indicates capable of self improvement,
- 2 indicates further instruction is required,
- 1 indicates remedial attention is necessary.

The two top categories reflect the reasonable goals of instruction in this, or any other, course.

The results in Table 1 are similar for both years because the course content was the same. However, in 2002 the course was presented with half the number of hours of formal instruction (6 instead of 12). The student survey, observation and anecdotal evidence shows that both the students and the demonstrators found this system easy to use and appreciated the more objective interaction. Overall, we conclude that up to 80% of the students reached a satisfactory level of competency in the Report Writing course, leaving about 20% who needed further practice and instruction.

The use of the initial test shows that less than 50% of the students had the necessary language skills before instruction. In the past, it has been automatically assumed that all students enter the course with the required language competencies. Table 2 shows a significant gain in student performance, with over 30% of the class moving into the satisfactory range of scores.

The Content section (as distinct from the Language section) of the course is drawn from the longstanding material in the existing laboratory instructions. This component was presented along side the Language section to provide an appropriate context for the course. Little significance can be attached to the slightly different levels of achievement between these two components, as they are quite different in content.

CONCLUSIONS

We have been able to show that the Report Writing course is both necessary and effective. The student surveys also indicate a growing level of acceptance and even popularity for the laboratory section of the unit. This can probably be attributed to the addition of the Report Writing course with its evolving design and clearly defined objectives. Credit should also be given to the demonstrators who participated so willingly and enthusiastically. The Scientific Content component of the course belongs within the physics culture engendered in the laboratory and is familiar to these demonstrators. However, these demonstrators do not claim to have the same authority for the Language component of the course and the expertise of the EAP academics is considered to be quite necessary.

The crucial features of this Report Writing course include:

- instruction by specialists in both physics and English language,
- the contents were determined after a careful study of existing practices,
- the structure was explained in functional terms and was open to discussion,
- the contents were placed in the essential laboratory manual,
- the course material is presented and assessed in the undergraduate laboratory,
- the assessment is continuous and does not impose additional tasks or require extra time from the students,
- simple criteria are laid down for effective marking and feedback.

ACKNOWLEDGMENTS

Peter S. Roger of the National Centre for English Language Teaching and Research at Macquarie University contributed much to the earlier phases of this work, including some of the teaching in 2001. These earlier stages were supported by Macquarie University Teaching Development Grants, followed by a Flagship Grant in 2001.

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